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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

DIVISION OF MYCOLOGY AND DISEASE SURVEY

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THE DISTRIBUTION OF RING ROT OF POTATOES (PHYTOMONAS SEPEDONICA) IN THE UNITED STATES

At the Richmond meeting last year the Potato Association of America appointed a committee charged with the task of coordinating research on certain new and unusual potato diseases. This committee felt that it could best serve this purpose by first making a survey to determine the extent of the occurrence of these diseases in the United States. Accordingly, in collaboration with the Division of Mycology and Plant Disease Survey plans were made for a nation-wide survey to determine the prevalence of bacterial ring rot and the so-called purple top wilt or blue stem. Because of the difficulty of definitely identifying purple top wilt or blue stem and because the etiology of the disease is not definitely known the survey for this disease has not been very successful. However, through the help of the collaborators of the Plant Disease Survey and other workers interested in potato diseases a fairly successful survey for ring rot has been completed.

The accompanying map presents in graphic form the results of the survey for ring rot. It will be noted that the disease has been reported definitely from 27 States. Negative, incomplete or inconclusive reports were received from the remaining 21 States. No attempt has been made in this map to show the distribution of the disease within individual States. A State shaded in the map merely indicates that the disease has been reported from at least one locality in the State. The negative reports do not necessarily mean that the disease does not occur in the State, for in most cases the cooperators have indicated that a very thorough survey had not been made. The survey has served to confirm earlier expectations that the disease would prove to be very destructive. Those who have observed the disease in regions where it is very prevalent uniformly agree that ring rot is a real threat to potato growing in this country. The following quotations are from letters received by the Committee in the course of the survey:

1. "The loss was about 20 percent in one field planted with certified seed."

2. "The loss in one county is estimated at 500 to 700 cars plus reduced price on several thousand cars."

3. "Many fields showed large amounts of this disease, infection in some cases reaching 100 percent."

4. "Tuber rot was very prevalent in 1937 and 1938, the estimated loss being about 25 percent."

5. "In one county the growers are becoming very discouraged because of serious losses. Potato acreage and production has declined 50 percent in the past three years."

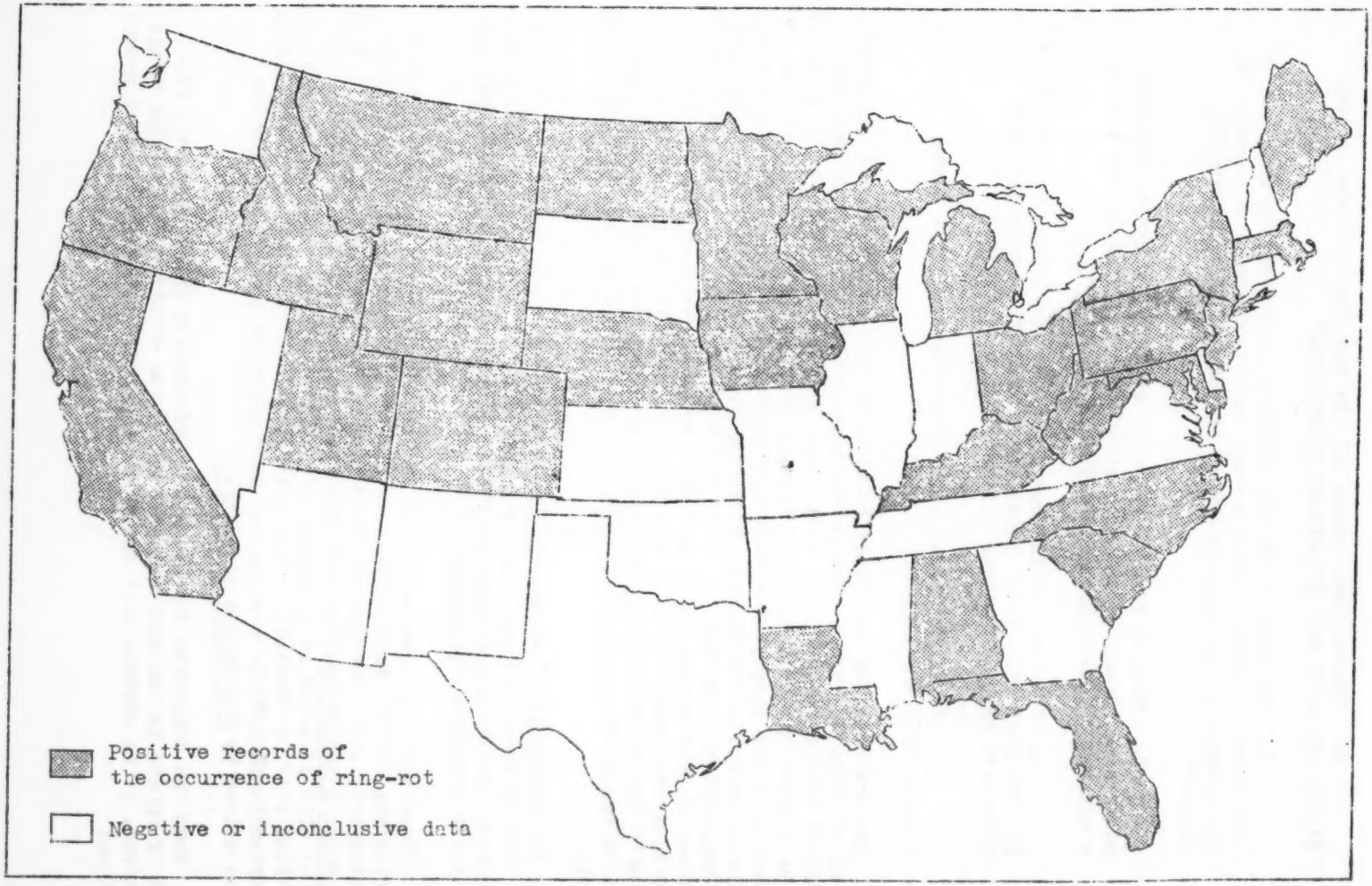

Figure 1. Known distribution, by States, of ring-rot of potatoes in the United States, 1939.

6. "Percentages range all the way from a trace in some fields up to 30 and 40 percent in others."

7. "My opinion of the economic importance of ring rot in this State is that it will become one of our major diseases. We are amazed at its rate of spread in some of our experimental plots."

8. "Unless drastic measures are taken against contaminated seed stocks it seems possible that the disease may become a menace to potato growing in this State."

9. "One grower indicated that he was likely to lose about $10,000 from ring rot. This fall I learned from fairly good authority that the actual loss was about $4,000."

10. "Ring rot is of major importance in this State. The loss in 1939 was probably $250,000."

Another point of considerable significance is the almost unanimous opinion of those who cooperated in the survey that the disease had been introduced into their State on seed stock that had been brought in from some outside source. Although largely circumstantial, there is a great deal of evidence that the disease has been introduced into the United States within relatively recent years or else it has suddenly become much more virulent. The former alternative appears most probable. It does not seem possible that a disease of this nature could have been present for very long without having been observed. If this conclusion is correct, we may expect the disease to become more widespread within the next few years unless some effective means of checking its spread is discovered and put into operation at once.

The possibility of introducing ring rot into new localities on seed stock shipped from State to State for experimental purposes should not be overlooked. Every potato research worker should recognize this danger and use all the safeguards possible.

There has been some confusion in the common names used to designate this disease. It has been called bacterial wilt, bacterial wilt and soft rot, ring rot, etc. Because of the danger of confusion with bacterial wilt (Phytomonas solanacearum) and soft rot (Erwinia carotovora) this Committee believes that it would be desirable to adopt a uniform name; and it believes that "ring rot" or "Bacterial ring rot" (a direct translation of the German "Bacterienringfäule") is perhaps the most suitable common name for the disease caused by Phytomonas sepedonica.

When one considers the available information about ring rot, its method of spread in the various sections of the country and possible means of control, it is obvious that there are numerous problems that need prompt attention:

1. A number of years ago several workers investigated the relative value of disinfecting seed tubers before and after cutting. At that time ring rot was not a problem, and the conclusions were generally in favor of treating the seed before cutting. It appears that with the appearance of ring rot the entire question has been reopened. Because of the apparent ease with which ring rot is spread by means of the cutting knife, the disinfection of cut seed pieces offers a promising means of control. Some of the newer fungicides may be well adapted to the disinfection of cut seed pieces without the usual seed injury.

2. The opinion appears to be rather prevalent that the pathogen of ring rot does not survive in the soil. However, because of the wide variation in environmental factors in different sections of the United States, it is highly desirable that this question be investigated further. We have practically no experimental evidence for the general assumption that the organism will not survive in the soil.

3. Our evidence on the spread of the disease in the field also is conflicting and inconclusive. It is imperative that we know the extent of field spread and, if the disease is spread in the field, what agencies are responsible.

4. European workers have stressed the value of planting whole tubers instead of cut seed pieces as a control for ring rot. A number of years ago this practice was discouraged in this country because of the increased probability of using virus-infected tubers when small tubers were selected for seed pieces. With the increased efficiency of virus disease control through certification, this objection appears no longer well founded. If ring rot continues to be a factor, the practice of using whole small tubers for seed purposes may be desirable.

5. The relation of volunteer plants to the overwintering of a pathogen in the field should be investigated. There is some evidence that very lightly affected tubers do not rot in storage and may transmit the pathogen. Similar tubers, surviving in the soil over winter, may be of considerable importance provided field spread occurs.

6. All available evidence indicates that the pathogen is very highly infectious, which would give added importance to the disinfection of containers, storage houses, as well as planting and grading machinery.

7. Several workers have reported to the Committee that it is difficult to detect the infection, both in plants growing in the field and in tubers in storage. Infected plants or tubers may show almost no injury, yet the tubers may produce badly infected plants. If seed certification is to be effective, a more accurate method for detecting infection is highly desirable. Investigations of this aspect of the disease might yield results of great importance in ring-rot control.

Educational Problems

Effective control of ring rot will depend not only upon certification practices and the research program, but will depend also on the effective education of the individual grower as to the danger of ring rot. It has taken many years to educate potato growers to an appreciation of the control measures that have been recommended for the older and better known diseases. If the control of this disease is going to necessitate radical changes in our control program, we cannot expect the general farmer to adopt this change without an intensive educational program. We must not forget also that certified seed constitutes only a small proportion of the potatoes that are planted. Much seed stock consists of potatoes sold for table stock, and the control of the disease in fields where certified seed are not used is going to present a difficult problem. The extension workers in plant pathology will face the problem of presenting new control measures and educating the farmer to a point where he will put them into practice. Because our present control program is only tentative and will probably be modified by the results of research, the extension worker must be constantly ready to modify his recommendations as the experimental evidence justifies.

T. P. Dykstra
R. W. Goss
J. G. Leach, Chairman
Committee to Coordinate
Research on New and
Unusual Potato Diseases

OCCURRENCE OF BACTERIAL RING ROT AND OF PURPLE TOP WILT ON POTATO IN MICHIGAN

J. H. Muncie

A number of lots of potatoes suspected of being infected with bacterial wilt and ring rot [Phytomonas sepedonica] have been received from several counties in the State to date. From the basis of the Gram test reaction on smears from affected tubers, the disease may be recorded as present in the following counties: namely, Berrien, Lenawee, Oceana, Tuscola, Monroe, and Van Buren.

In every case but one these tubers came from table stock fields. We have attempted to trace the source of infection in these lots but so far have failed to do so as the original seed, in all cases but one, has, so far as we know, never shown any serious disease.

A field survey for this disease was considerably hampered by drought conditions, and a little later I found a serious infection with the late blight disease [Phytophthora infestans]. Owing to these conditions, it was impossible to find bacterial wilt and ring rot in the field during the past

season, and our records, therefore, are based on smears made from suspected tubers.

With regard to purple top wilt of potato, we find this disease generally scattered throughout the State in very small amounts in many fields. As far as I have been able to find, the purple top wilt disease is identical with one which we have known here in Michigan since 1915 as moron. Consistent rogueing throughout the State has kept purple top wilt at a minimum. It is difficult to find a field which would show over a tenth of one percent where the potatoes are used for seed. In addition to rogueing, the production of flabby tubers from affected plants tends to eliminate the disease from the seed stock, since tubers so affected are thrown out in sorting.

(Michigan State College. December 11).

THE POTATO WART ERADICATION PROGRAM IN PENNSYLVANIA

T. P. Dykstra

A serious disease of potatoes, known as the European potato wart disease [caused by Synchytrium endobioticum], became established in certain localities of Pennsylvania, Maryland, and West Virginia about 25 years ago, owing apparently to shipments of infected tubers from Europe. The Bureau of Plant Industry, U. S. Department of Agriculture, cooperating with the Pennsylvania State College during the years 1919 to 1922, started experiments in soil treatment for the eradication of the potato wart. The results secured discouraged further investigations along these lines, and for a 10-year period (1922 to 1932) all hope of ultimate elimination of the disease from affected areas was based upon a slow process of starvation of the causal organism.

In 1933 the Pennsylvania Department of Agriculture renewed studies in soil sterilization by testing some new herbicidal thiocyanates. These studies have been continued and a comprehensive program of eradication by soil sterilization is now conducted by the Pennsylvania Bureau of Plant Industry under the direction of R. E. Hartman, Principal Pathologist.

Affected gardens are treated with ammonium thiocyanate at the rate of 2000 pounds per acre, but recently flaked copper sulphate at the rate of 2500 pounds per acre has been used successfully. These treated gardens are check-planted with wart-susceptible potato varieties the first week of July and harvested the latter part of October. At that time each tuber is examined for the presence of the wart disease. If, during a period of 5 years, the wart disease fails to develop on potato tubers in treated gardens, it is assumed that soil sterilization has completely eradicated the causal organism. After all known infections have been treated in an area, the regulations are modified to permit the growing of susceptible potatoes under a special planting permit. The crop, however, must be harvested under rigid supervision.

The writer has observed the application of these herbicides to affected gardens, and also was present during the harvesting of susceptible varieties planted in treated gardens. Not a single infected tuber was found in any of the gardens treated.

The present wart quarantine areas in Pennsylvania include the whole of 4 townships and 40 scattered towns and villages in 13 counties, but infection is confined entirely to home gardens, of which 928 have been found to be contaminated. Quarantine regulations adopted for these areas prohibit the movement from such localities of any material capable of spreading the disease, regulate the growing, harvesting and marketing of potatoes, and provide for eradication of the disease by approved control measures.

Soil treatment for eradication of potato wart has been applied to all known affected gardens of 8 areas. After 5 years' checking of all potato plantings in these communities without finding any evidence of potato wart, the Department of Agriculture of Pennsylvania has determined that the quarantine may be safely removed from the areas affected at these various points. Similar eradication work is under way in 18 other quarantined areas and further removal of restrictions will follow where eradication is proved successful.

An important part of the eradication program is the check-up survey to ascertain if any additional wart infections are present in these eradicated areas. This is accomplished by modifying the regulations governing the growing of potatoes in these areas. After all known infections have been treated, the modified regulations permit the growing of susceptible potatoes under a special planting permit, the crop, however, to be harvested under the supervision of an official Potato Wart Inspector.

All indications are that a continuance of the effective eradication program now in progress in Pennsylvania will result in the complete elimination of the wart disease in this State.

(Division of Fruit and Vegetable Crops and Diseases, U. S. Bureau of Plant Industry).

COLLAR-ROT INFECTION ON DIRECT-SEEDED TOMATOES

H. Rex Thomas

An excellent opportunity was presented in Indiana during the 1939 tomato season to observe collar-rot infection on tomato plants "direct-seeded" on land, part of which was set to tomatoes in 1938. A greater number of infected plants were found in that portion of the field which had previously been in tomatoes.

The observations were made on a 60-acre field which was in tomatoes last year except for strips about 50 feet wide along 2 sides of the fields planted to soybeans. In 1938, the tomato plants in this field were severely defoliated by Macrosporium and Septoria leaf spots [Alternaria solani and Septoria lycopersici]. In 1939 the seed was checked in hills with a corn planter about the last of April, and the plants were thinned when only 3 or 4 inches high. Fertilizer was checked in the row and the plants made normal growth during the season except for being retarded by dry weather during May.

Collar-rot-affected plants were first noticed in July and counts were then made in different sections of the field. The results recorded in the accompanying tabulation show that 5.9 percent infection was found in that portion of the field in tomatoes last year, and 0.4 percent in that part which was in soybeans. Two rows of home-grown plants set through the middle of the field about the time the "direct-seeded" plants were thinned had only 0.2 percent infection.

Appearance of Collar-Rot in "Direct-Seeded" Tomatoes

	Number of plants counted	Percent collar-rot infection
Home-grown transplants on ground in tomatoes last year	1550	0.2
"Direct-seeded" plants on ground in tomatoes last year	3100	5.9
"Direct-seeded" plants on ground in soybeans last year	1900	0.4

The first evidence of infection was found when several plants with necrotic spotting of the new growth were noticed. Several such plants were pulled up and typical collar-rot lesions were found on the stem just below the surface of the soil on all plants showing this necrotic spotting of the leaves. This type of necrosis has been frequently noticed as a later development on the new growth of plants which had collar-rot lesions at time of setting. A similar condition has also been seen many times on tomato plants grown in nutrient culture from seed artificially inoculated with spores of Macrosporium solani [Alternaria solani].

No pathogenic organism was recovered from any of these spots. Dr. O. C. Whipple of the Wisconsin Agricultural Experiment Station has reported a toxin produced by the fungus and his preliminary studies suggest that it has a causal relation to this necrosis.

It appears that sufficient inoculum of the pathogens was built up on the tomato debris of the previous season to cause collar-rot infection on the plants this year. The evidence also indicates that wind spread of spores and dead leaves the previous year did not serve to affect seriously the adjacent portion of the field which was in soybeans the previous year. The disease counts on the new land were made on 2 sides of the field, not over 20 feet from where the counts on the old tomato land were made.

Unfortunately, no other observations were made elsewhere in the State this year as a comparable situation could not be located. However, in 1938, approximately 80 percent of the tomato plants in a "direct-seeded" field were reported infected with collar-rot. This field was located in a region where it is the practice to raise tomatoes on the same land every year.

In Indiana most of the tomatoes are raised on land which has not been in this crop for several years. This practice was primarily initiated to reduce the damage from fusarium wilt. The increasing practice of "direct-seeding" fields to get a stand of plants may further encourage a suitable rotation schedule to eliminate trouble from other tomato diseases.

(Division of Fruit and Vegetable Crops and Diseases, U. S. Bureau of Plant Industry, cooperating with Purdue University Agricultural Experiment Station).

BLACKSHANK ON TOBACCO IN KENTUCKY

W. D. Valleau and E. M. Johnson

Blackshank (Phytophthora [parasitica] nicotianae) was found on August 31, 1939 on four farms in south Logan County, Kentucky, near Adairville, and on a farm in north Robertson County, Tennessee. The disease was observed by Valleau and Johnson (PDR 19: 251. Oct. 1, 1935) in 1935 in 2 fields of tobacco in Todd County, Kentucky. The growers were advised not to use these fields for tobacco again. So far tobacco has not been grown again in either of these fields and the disease has not reappeared in Todd County since 1935.

Blackshank was found on the Tennessee farm in 1936 in the same field where the disease appeared in 1939. In 1936, 2 acres of tobacco were destroyed on this farm and in 1939, 12 plants were found in areas where the disease occurred in 1936. In 1936 the evidence was clear that the disease was carried to this field by drainage water from a field on one of the Logan County farms, where tobacco had died in 1935 from what, from the description, appeared to be blackshank.

This Logan County farm is higher than any of the others and it appears that the surrounding farms have had the disease carried to them by drainage water from this one. About half an acre of dark fire-cured tobacco was destroyed on this farm in 1939. How long the disease has been present here is not known.

A one-sucker tobacco field on another of the Logan County farms was in tobacco in 1938 and plants died of blackshank. In 1939, 32 percent of the standing plants were killed. Most of the tobacco had been cut when these observations were made. The percentage of infection was probably as great as 50 or 60 because the plants were cut as they wilted in order to save them.

The third Logan County farm showed the disease in 1938 in a field contiguous to the high farm mentioned above. In 1939 the disease appeared in both Burley and dark fire-cured tobacco in a field, not in tobacco for 3 years, which received drainage water from the 1938 tobacco field. It was not possible to get percentages of infection because much of the tobacco had been cut. In the dark fire-cured tobacco 115 plants were killed in one low part of the field and in 2 Burley fields, of 1/4 acre each, 95 dead plants were found. On higher areas of the field where overflow was unlikely, both Burley and dark fire-cured tobaccos escaped infection.

Although a few hundred yards away, a one-sucker tobacco field on the fourth Logan County farm, not in tobacco for 6 years, received drainage from the 1938 tobacco field on the third farm. Water from the latter entered the one-sucker field at one corner and formed a gully diagonally across it, spreading out over a portion of the field at one low area at the end. Sixty plants killed by blackshank were found along the gully. Many more had been affected because the grower cut plants along this gully as they began to wilt. Most of the tobacco plants in the low area where water collected from the gully had been cut; according to the grower, because they were yellowing and wilting. Plants in areas of the field receiving no drainage water from the other farm escaped infection.

(Kentucky Agricultural Experiment Station).

TOBACCO DISEASES IN KENTUCKY IN 1939

W. D. Valleau and E. M. Johnson

Wildfire and angular leaf spot [Phytomonas tabaca and P. angulata]: Despite low rainfall during the latter half of the growing season bacterial leaf spots caused serious damage in many fields of one-sucker and dark fire-cured tobacco. A summer-long study indicated that the greater damage occurred in tobacco fields set from beds that were infected with either one or both diseases. Losses ranged from a trace to 50 percent. As in years past many growers who had the disease were forced to cut immature tobacco, which added greatly to the loss. Neither wildfire nor angular leaf spot caused damage in fields set from beds treated twice with Bordeaux mixture. The material was applied with a sprinkling pot at the rate of one quart per square yard. The purpose of the treatment appears to be to cover the soil with Bordeaux rather than to cover the plants. Consequently the sprinkle method is satis-

factory. There appears to be a tendency, if a spray outfit is used, to cover only the plants and cut down the rate of application. It is not so effective as the sprinkle method. Burley tobacco growers who have used the treatment also find it valuable in producing healthier plants. The extremely wet plant-bed season seemed in some way to be associated with extensive outbreaks of wildfire in the central bluegrass area on farms where the disease was apparently unknown before. This association between extremely wet springs and outbreaks of wildfire has been noted before.

Mosaic [virus]: Tobacco mosaic caused greater total damage in the dark fire-cured and one-sucker tobacco areas than the bacterial diseases. High percentages of infection occurred in fields handled by workmen who used home-cured tobacco. Growers who used commercial tobacco or none at all had no mosaic problem. Mosaic-burn strains were common and destructive throughout the area. Growers often confused mosaic-burn with wildfire and, thinking they had the latter, cut immature tobacco. In spite of the knowledge of mosaic control and extension work mosaic continues to be a problem.

Arsenical burn: Many fields in the dark tobacco area were seen where the damage from arsenate of lead or Paris green was as high as 10 percent. Few growers use dusters. Most of them apply either arsenate of lead with or without a diluent or Paris green diluted with hydrated lime with an open mesh cloth bag. Where either of these poisons collect in quantities on the leaves of ripening dark tobacco, circular necrotic zonate spots 1/4 to 1/2 inches in diameter develop. Sometimes the poison dusts collect along the midribs and cause the latter to shrivel. Growers are of the opinion that greater injury occurs when arsenate of lead or Paris green are applied when dews are heavy.

Potash hunger: Many fields of one-sucker, Burley, and dark fire-cured tobaccos developed potash starvation. One-sucker tobacco appears to be especially sensitive to a low concentration of soluble potassium in the soil and the symptoms are more striking than in other types. Tests by the Purdue method for soluble potassium in 16 fields where potash starvation symptoms were striking showed soluble potassium to be very low. High pH of the soil induced by liming seemed to intensify potash starvation.

Frenching, often accompanied by potash hunger, was observed in many fields. As in years past this disease often appeared in a few rows of tobacco parallel to limestone roads. Electrometric determinations of hydrogen ion concentration showed that all of soil areas where frenching occurred had a pH of 5.58 to 6.51.

Frogeye [Cercospora nicotianae] was present in a high percentage of Burley fields and was seen occasionally on dark fire-cured and one-sucker tobaccos. In the latter 2 types growers often confuse the frogeye spot with wildfire because of the often striking halo. For some reason frogeye has been more prevalent the past 3 years than in many years previous. While

frogeye spots on ripening Burley are not injurious late infections on upper leaves cause bright green spots on the cured leaves if the tobacco is cured at relatively low humidity or nearly black spots on tobacco cured at high humidity. These spots detract considerably from the value of the tobacco but fortunately most of this type of spotting occurs on low-priced tobacco.

Black root rot [Thielaviopsis basicola] was severe where it occurred this year. It is no longer much of a factor in Burley tobacco because of the increasing use of root-rot-resistant Burley No. 16. This variety was distributed to a few farmers in 1935. In 1939 enough certified seed was sold through the Kentucky Seed Improvement Association to plant well over 50 percent of the acreage grown in Kentucky and neighboring States.

Streak: This virus disease has been reported more often in the past 3 years than in the 16 previous years. A study of its distribution indicates that the probable source of the virus is sweetclover growing along fence rows and in waste places near fields of tobacco.

(Kentucky Agricultural Experiment Station).

FIRST PROGRESS REPORT ON THE PHYMATOTRICHUM ROOT ROT LOSSES IN EXPERIMENTAL WINDBREAKS OF OKLAHOMA AND TEXAS 1/

Ernest Wright

In the study of Phymatotrichum root rot (Phymatotrichum (Ozonium) omnivorum (Shear) Duggar) as affecting the windbreak plantings in Oklahoma and Texas, it was first necessary to determine the western and northern boundary limit of root rot infestation, so that planting plans could proceed on a safe basis. This was accomplished by surveys made in 1935 2/ by Peltier and Schroeder, and in 1938 by Peltier, Schroeder, and Wright 3/. The boundary lines as established by these 2 surveys have been found in a recent check-up in the summer of 1939 to be unchanged, so that the Prairie States Forestry Project may safely rely upon their accuracy. As it has been 4 years since the first survey was made (1935) and there has been no noticeable alteration in the boundary lines established at the earlier date, it seems unlikely that there will be any important change in this respect in the near future.

1/ Study directly in cooperation with Prairie States Forestry Project, through whose assistance it was made possible.

2/ Peltier, George L. Distribution and prevalence of Ozonium root rot in the shelterbelt zone of Texas. Phytopath. 27: 145-158. 1935.

3/ Peltier, George L., F. R. Schroeder, and Ernest Wright. Distribution and prevalence of Ozonium root rot in the shelterbelt planting area of Oklahoma. Phytopath. 29: 485-490. 1939.

Taubenhaus and Ezekiel 4/ and Streets 5/ have already published ratings as to the relative susceptibility of practically all the species used in windbreak plantings, to say nothing of many other species with which we are not concerned at this time. The fact remains, however, that most of the work done by Taubenhaus and Ezekiel was carried out at College Station, Texas, where the average annual rainfall is much higher and the soil type is different than that within the windbreak zone where the Prairie States Forestry Project plantings are being made. Likewise, Streets' investigations were made largely on irrigated lands in Arizona, which may also alter conditions sufficiently so that his ratings may not necessarily apply to windbreak plantings. It seemed advisable, under the circumstances, therefore, to proceed cautiously and determine independently the relative resistance and susceptibility to Phymatotrichum root rot of the various tree species used in windbreak plantings.

With the completion of the 1935 survey, it was suggested that a few miles of experimental windbreak should be set out on root-rot infested soil, in order to determine the relative resistance of various tree species under the dry land conditions of the Great Plains region. There were one or two experimental plantings made in 1936 and 1937, but the majority of these experimental plantings were established in 1938, and a few plantings were also made on root-rot soil in 1939. All of these experimental windbreak plantings were examined during August of the present year. Richard K. Spears, Jr., assisted in the examinations of the experimental windbreaks in both Texas and Oklahoma, and Theodore E. Raide assisted to some extent in Oklahoma. The results of these examinations are presented at this time as a matter of record for all who are interested in the progress of this work.

Method of Investigation

Approximately 27 miles of experimental windbreaks planted by the Prairie States Forestry Project were inspected for Phymatotrichum root-rot losses in Oklahoma and Texas between the dates of August 7 and 19. Of this total mileage, about 7 miles were critically examined and detailed notes taken on the losses of the various species. These experimental windbreaks were chosen for critical examination because of their good cultural condition. Only general notes were taken on the balance of the mileage because portions were weedy or in poor cultural condition and such conditions may alter the Phymatotrichum root-rot losses.

4/ Taubenhaus, J. J., and Walter N. Ezekiel. A rating of plants with reference to their relative resistance or susceptibility to Phymatotrichum root rot. Texas Agr. Expt. Sta. Bul. 527. 1936.

5/ Streets, R. B. Phymatotrichum (Cotton or Texas) root rot in Arizona. University of Arizona Tech. Bul. 71. 1937.

Determination of the presence or absence of root rot on dying or dead trees consisted of digging a few trees from each root-rot spot and examining the roots both as to the physical condition and for the presence of the typical fungal strands (mycelium) as detected by a hand lens. In some cases the dying of adjacent cowpeas or cotton was available as further corroborative evidence of the presence of Phymatotrichum root rot. Special attention was given to the seemingly more resistant species, such as Osage orange, hackberry, green ash, sycamore, and desert willow. With the exception of Osage orange, practically 100 percent of the dying trees of such species were dug and the roots examined with a hand lens. About 50 percent of the Osage orange found dying was dug and examined critically. For such susceptible species as Chinese elm and cottonwood, it was possible to dig only a few of the dying trees for critical examination of the roots. The evidence, therefore, for the very susceptible species is based quite largely on external appearances and the character of the dying, and it may be necessary to discount to some extent the findings for such species, especially in regard to the exact number killed by Phymatotrichum root rot. The ratings on susceptibility of the various species, however, should be substantially correct for the current year.

Description of Root-Rot Losses

Phymatotrichum root rot spreads rapidly from the infected roots of one tree to those of an adjacent tree, and so on down the row in a longitudinal direction. Spread may also be laterally across a windbreak from the roots of one susceptible species to those of another. Typical Phymatotrichum root rot shows in the experimental windbreaks in roughly circular spots. These spots spread gradually until they coalesce, and finally all the susceptible trees within the spot are killed.

Infected trees usually show a somewhat stunted growth at first, then the leaves begin to turn yellow to bronze and gradually drop off, giving the crown a thin appearance, as in cottonwood. Or, the leaves may remain attached, dry, and curl up, becoming blackish, but still cling to the branches, as for Osage orange or honey locust. Even when such above-ground symptoms of Phymatotrichum root rot appear, for positive determination of the cause it is necessary to dig out some of the roots of the trees from each suspected root-rot spot and to examine carefully with a hand lens for the presence of tell-tale mycelial strands. These strands are most easily detected on the roots of infected plants growing in a loamy soil. After the dirt is carefully shaken from the roots, an examination with a hand lens generally reveals the presence of the buff-to-brown fuzzy strands. When the strands are young they are just as fuzzy as but lighter in color than the older strands, and sometimes they are almost white. It is more difficult to detect the Phymatotrichum mycelial strands on trees removed from sandy soils, since it is difficult to shake off the sand particles without removing the mycelial strands. Frequently the strands hang from the roots in a cobwebby fashion, with the finer sand particles clinging to them.

Table 1. Losses caused by Phymatotrichum root rot in representative windbreaks in Texas and Oklahoma.

Windbreak	Apricot		Green Ash		Chinese Elm		Cottonwood		Honey Locust		Mulberry		Desert Willow		Osage Orange		Hackberry		American Elm		Tamarix		Sycamore		Catalpa	
	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed	Number Planted	Killed
TEXAS																										
Ramming---																										
1938					762	81	777	5	386	10					510	1			380	3						
Bassett---					865	*29					718	23			875	17	720	2	179	4	377	3				
1938						117						31								11						
Cooper---					491	1	502	6	260	1	240	1														
1938						44				1		4														
Bitner---																										
1938			359	2	830	41	1649	19	839	16	811	2			978	3							356	7	800	5**
Bitner---																										
1939			440	10									660	1	440	15	440	1					660	33		
OKLAHOMA																										
King---					1320	16	1320	40		3	1980	2			1980	2	1980	1								
1938										11																
Cowan---																										
1938									480	33	1069	18	660	2	865	25										
Deer-1937	823	1				30	1783	108	1957	3	225	29			1035	2	255	1								
										139						44										
Adams-1938					350	25	700	46	700	20	772	15			800	5										
TOTALS	823	1	799	12	4618	384	6731	224	4622	237	5815	125	1320	3	7483	114	3395	5	559	18	377	3	1016	40	800	5
Percent		.1		1.5		8.3		3.3		5.0		2.1		.2		1.5		.1		3.0		.8		4.0		.6

*Note---Figures underscored represent number of trees killed in 1938.

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Table 2. A comparison of the ratings of some tree species as to resistance or susceptibility to

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Table 2. A comparison of the ratings of some tree species as to resistance or susceptibility to Phymatotrichum root rot.

Common name	Technical name	Rating by Streets	By Taubenhaus & Ezekiel	Windbreaks - 1939
Ailanthus (Tree of Heaven)	Ailanthus altissima	Very susceptible	Highly susceptible	Resistant so far
Apricot	Prunus armeniaca	Very susceptible	Highly susceptible	Resistant so far
Ash, Arizona	Fraxinus velutina var. Toumeyi	Slightly susceptible	-----	None in windbreaks
Ash, Green	Fraxinus lanceolata	-----	Moderately susceptible	Slightly susceptible
Catalpa, Western	Catalpa speciosa	Moderately susceptible	Highly susceptible	Moderately susceptible
Cedar, Eastern red	Juniperus virginiana	Slightly susceptible	Slightly susceptible	No rating. Limited observation
Cedar, Mountain	Juniperus mexicana (asheii?)	-----	Resistant	None in windbreaks
Cedar, Western red	Juniperus scopulorum	-----	Slightly susceptible	No observations
Coffee tree, Kentucky	Gymnocladus dioica	-----	Resistant	Resistant (only in one windbreak - Oklahoma)
Cottonwood	Populus deltoides	Very susceptible	Extremely susceptible	Very susceptible
Elm, American	Ulmus americana	-----	Highly susceptible	Moderately susceptible
Elm, Cedar	Ulmus crassifolia	-----	Resistant	None in windbreaks
Elm, Chinese	Ulmus pumila	Very susceptible	Extremely susceptible	Very susceptible
Hackberry	Celtis occidentalis	-----	Resistant	Slightly susceptible
Hackberry, Southern, or Sugarberry	Celtis laevigata	-----	Resistant	No observations
Locust, Black	Robinia pseudoacacia	Very susceptible	Extremely susceptible	Susceptible (limited observations)
Locust, Honey	Gleditsia triacanthos	Very susceptible	Extremely susceptible	Very susceptible
Mulberry, Russian	Morus alba var. tartarica	Moderately susceptible	Highly susceptible	Very susceptible
Olive, Russian	Eleagnus angustifolia	Slightly susceptible	Resistant	Resistant (only in one windbreak - Texas)
Osage orange	Toxylon pomifera	Slightly susceptible	Resistant	Moderately susceptible
Persimmon	Diospyros virginiana	-----	Moderately susceptible	No observations
Plum, American	Prunus americana	-----	Moderately susceptible	No observations
Siberian pea	Caragana arborescens	Slightly susceptible	Slightly susceptible	No observations
Soapberry	Sapindus drummondii	-----	Extremely susceptible	Resistant so far
Sycamore	Platanus occidentalis	Slightly susceptible	Resistant	Moderately susceptible
Tamarix	Tamarix spp.	Slightly susceptible	Resistant to moderately susceptible	Resistant so far
Walnut, Arizona	Juglans major	Slightly susceptible	-----	None in windbreaks
Walnut, Black	Juglans nigra	Moderately susceptible	Highly susceptible	Resistant so far

An infected root usually is badly rotted and the root epidermis is shrunken and shriveled. Typically, Phymatotrichum rot is a dry rot rather than a wet rot, although for Chinese elm it may be described as a typical wet rot. It will be found that young seedlings which have been infected with Phymatotrichum root rot are much more easily pulled from the soil than the sound or healthy seedlings, and the roots show little if any resilience upon bending. The criteria described were used to determine the presence or absence of Phymatotrichum root rot in these investigations. No cultural procedure was followed, but microscopic verification was made in several cases where there was some question as to whether desert willow plants were infected with Phymatotrichum.

Results of 1939 Examinations for Phymatotrichum Root Rot Losses in Experimental Windbreaks

Summation of the data collected during the current year's examinations for Phymatotrichum root rot are presented in Table 1, but as earlier indicated, not all the experimental windbreaks are included in this table. Only the well-cared-for windbreaks were considered as reliably indicative for root-rot-loss determinations. From the data included in Table 1, it is evident that such species as Chinese elm, honey locust, cottonwood, and mulberry should without question be eliminated from windbreak plantings on root-rot-infested soil. Such species as Osage orange, sycamore, and American elm appear of doubtful value. Other species, such as catalpa, have not been observed frequently enough to form a reliable estimation of their resistance to Phymatotrichum infection.

The relatively small number of any species killed this year by Phymatotrichum omnivorum may be misleading. The facts are that these losses are cumulative from year to year, so that in a few years they may reach discouraging amounts, especially for the very susceptible species. Since our study of Phymatotrichum root-rot losses in experimental windbreaks has only recently been undertaken, the results we have secured should not yet be regarded as final. The findings of Taubenhaus and Ezekiel and of Streets are based on years of study, whereas our observations only extend over a year or two and are derived mostly from young trees which do not always react to root rot in the same way that older trees of the same species do. As already pointed out, however, their ratings may not necessarily apply to the dry land conditions existing in the Prairie States Forestry Project experimental windbreaks. For the purpose of easy comparison, a composite tabulation of Taubenhaus and Ezekiel's and Streets' ratings, together with our findings, based on this season's investigations, are presented in Table 2.

It is apparent from the examination of individual species listed in Table 2 that there is considerable disagreement on the ratings of some of the species. Some of these ratings, so far as our determinations are concerned, will probably change in the future, and may eventually agree more closely with the findings of Streets or Taubenhaus and Ezekiel. At this

time, however, it does not appear that Osage orange can be regarded as a resistant species. Likewise, sycamore, at least in the seedling stage, is disappointingly susceptible to Phymatotrichum root rot. However, an allowance for the source of stock should be made, since it is understood that most of the sycamores planted in the experimental windbreaks this past season were purchased from commercial nurseries, and the source of seed is unknown. Osage orange and sycamore have, without question, been killed by P. omnivorum much more extensively than expected, according to the ratings given them by Taubenhaus and Ezekiel or Streets. It appears that these two species in particular should have further tests.

Some of the species listed by Taubenhaus and Ezekiel or Streets as susceptible have been found to be standing up very well under the conditions existing in the experimental windbreaks. A good example is the ailanthus, or tree of heaven, which was rated as very susceptible by Taubenhaus and Ezekiel. This species has survived practically 100 percent in experimental windbreaks located under conditions of severe root rot. Kentucky coffee tree shows considerable promise, but has not been sufficiently tested under windbreak conditions. Another species, the cedar elm (Ulmus crassifolia), has not been tested at all, but it certainly should be in the future, since Taubenhaus and Ezekiel consider this species as only slightly susceptible to root rot. Green ash, rated as moderately susceptible both by Streets and by Taubenhaus and Ezekiel, rates as only slightly susceptible in the experimental windbreak plantings. Black walnut (Juglans nigra) likewise shows more resistance to root rot infection in our experimental plantings than given by either Streets or Taubenhaus and Ezekiel. Arizona walnut (J. major), rated as only slightly susceptible by Streets, should also be included in our experimental windbreak plantings in the future. Soapberry, found to be highly susceptible by Taubenhaus and Ezekiel, so far has proved to be highly resistant to root rot in the experimental plantings. However, as shown by Table 1, there has so far not been adequate use made of this species. Another surprising species is apricot, rated as very susceptible by Streets and moderately susceptible by Taubenhaus and Ezekiel, and yet found by us to be resistant to root rot. For these two species, soapberry and apricot, some further evidence not shown in the tables should be presented at this time. Most of the apricot seedlings examined were replants, and in such cases this tree was standing up well. On one abandoned windbreak in Texas, south of Vernon, a row of apricot has been planted close to an outside row of Russian mulberry. In 6 cases observed at the time of examination, the mulberry bushes were dying from root rot, but the 2-year-old apricot seedlings adjacent to and not more than 3 feet from the dying mulberry bushes were thriving and showing no external signs of infection. For soapberry, the only extensive plantings observed were on a windbreak in Oklahoma. Soapberry was used as a replant. There are now 151 trees of this species standing in this windbreak. None are dying from root rot. In a few cases, the soapberry is growing adjacent to and in contact with mulberry bushes which have died from root rot. These particular cases need further investigation.

From our investigations so far, it seems quite clear that there will be no species which can be used in windbreak plantings on root-rot infested soil that will be entirely immune from or nonsusceptible to Phymatotrichum omnivorum. In general, seedlings are considered to be more susceptible to root rot than older trees.

(Division of Forest Pathology, U. S. Bureau of Plant Industry, in cooperation with Prairie States Forestry Project).

THE DISTRIBUTION OF ZILVERBLAD OR WHITE STREAK IN NARCISSUS PLANTINGS ON THE WEST COAST 1/

Frank P. McWhorter

"Zilverblad", the term used in Holland for the narcissus disease locally called white streak is, according to Dr. Van Slogteren (letter 1938), the preferred name. Test plots maintained at the Oregon Experiment Station for a 3-year period and recent mild forcing tests have shown that the white-streak symptoms are the end expression of various obscure white and purple streaks. Frequently white and purple streaks occur on the same plant. Such plants, when subjected to relatively high temperatures during the growing period either out-of-doors or under greenhouse conditions, become typical white-streak plants. In other words, white streak is the chief and final symptom of the disease complex referred to in the Plant Disease Reporter (22: 147-148, 1938) as the "Decline Disease" of narcissus. It has been recently shown independently at Cornell University and at this Station that the disease is transmissible and probably of virus nature.

The white-streak complex is of great economic importance since it causes bulb stocks to "run out." One reason for this is the very early maturity induced by the disease, which causes the plants to ripen shortly after blooming, thus circumventing the normal growth period of the bulb. The purpose of this report is to show the varietal distribution of the disease and the bearing of such a record on its date of origin. This season (spring 1939) having been unusually warm, has proved exceptionally favorable for such a study, significant white-streak symptoms having been developed abundantly.

The writer has observed white streak in King Alfred plantings from Santa Cruz, California to Northern Washington. The amount of the conspicuous form of the disease in this variety averaged very close to 5 percent. This would indicate a common origin within the variety and a yearly increase by methods of propagation rather than by natural spread.

1/ Received June 6, 1939. Approved December 9, 1939.

The following groupings follow the Royal Horticultural Society list of classified daffodil names. The dates refer to the earliest record of the variety as a named or recognized variety. Unfortunately, these records do not correspond exactly with the date of origin and it is not always possible to assign the location of origin since new varieties are sold from breeder to producer and named by the latter. However, the dates to some extent may point to the time of the origin of this disease.

Division 1a - Yellow Trumpets: Typical white-streak symptoms have been found in the following: Emperior 1890, King Alfred 1899, Van Wavereh's Giant 1900, Hector Treub 1918, Matamax 1921, Bassanio 1923, Alasnam 1923, Tresserve 1923, Henrik Ibsen 1927, Lucullus 1927, Minister Talma 1930, Early Giant 1930.

The varieties Cromwell 1916 and Liberty 1937 represented doubtful cases showing only purple and brown streaks. The varieties Olympia 1900 and The First 1930, were negative for white streak in the plantings examined. In the above list, the varieties Minister Talma and Emperor are of special interest. One white-streak diseased plant was found in a field of Minister Talma which contained only 20 typical mosaic plants among 100,000 healthy. Plantings of Emperor the oldest variety in the list, usually show no white streak or only a trace, while Alasnam dated 33 years later may average 10 percent. White streak is very abundant in the large yellow trumpets.

Division 1b - White Trumpets: Typical white-streak symptoms were found in the variety Mrs. Betteridge 1910. Mild symptoms were found in variety Peter Barr 1928. No symptoms were found in Point d'Aigu 1929, Matterhorn 1928, and Silver Glory 1920. The disease was very mild in affected 1b white trumpets and did not appear to be damaging the plants very greatly.

Division 1c - Bicolors: Typical white-streak symptoms were found in the following varieties: Victoria 1897, Spring Glory 1914, Latonia 1921, Glory of Sassenheim 1923, Jefta 1927, Phenomena 1928, Erasmus 1928, Martha 1928.

No white-streak symptoms found in Diogenes 1907, Spinoza 1928, Golden Beauty 1930. The effect on the plant seems greatest in the varieties Victoria of this group and Tresserve of the yellow trumpets.

Division 2a - Incomparabilis - Yellow Shades: Typical white-streak symptoms were found only in Helios 1912 and Lucinius 1928. Very doubtful symptoms were found in Sir Watkin 1884 and Croesus 1923. No indications of the disease were found in Autocrat 1890, Torch 1907, Stella Pratt 1923, Fortune 1923, Marigold 1923, Ghandi 1927, Spartacus 1927, Red Cross 1928.

The situation in Sir Watkin is especially interesting. These plants frequently develop a general yellowing which we have never been able to explain. Inoculations now in progress on Sir Watkin indicate that the yellowing usually associated with early maturity in this variety differs from the white-streak complex. The fact that Helios and Lucinius both show typical white-streak symptoms proves that the group is not immune and further indicates a low coefficient of spread for the disease.

Division 2b - Incomparabilis - Bicolors: No typical symptoms of white streak were found in any of the 9 varieties studied at various locations. Markings suggestive of symptoms were observed in the variety White Star 1923 which exhibited a browning, possibly associated with the white-streak complex. The varieties listed below showed no symptoms: Lucifer 1890, Will Scarlett 1898, Great Warley 1904, Bernardino 1907, Whitewell 1910, John Evelyn 1920, Tampa 1928.

The case of Lucifer 1890 is especially interesting since it was growing in a location where white streak was abundantly developed yet showed no indications of the disease. As usual, however, it was about 100 percent mosaic.

Division 3a - Barrii - Yellow Shades: No typical symptoms of white streak were found in any of the varieties studied. The following were observed: Barrii Conspicuus 1886, Blood Orange 1907, Bath's Flame 1914, Alcida 1923, Nanny Nunn 1923, Diana Kasner 1927.

Division 3b - Barrii - Bicolors: Typical white-streak symptoms were found in only one variety of this group, namely in Pink Pearl 1908. No symptoms were found in the following varieties observed: Talisman 1907, Red Chief 1910, Lady Moore 1916, Village Beauty 1920, Sir Lancelot 1928, Nursemaid 1928, Triomphator 1930.

Division 4a - Leedsii - Medium Trumpets: Only one example of this group was studied, namely, Duke of Marlborough 1927. It showed no white-streak symptoms.

Division 4b - Leedsii - Short Trumpets: These are mostly old-time varieties and are not much grown at present. No suggestive symptoms were observed in Mrs. Langtry 1890, White Lady 1898, or Queen of the North 1908.

Division 5b - Triandrus Hybrids: Typical white-streak symptoms were found in the variety Vesta 1907. Doubtful symptoms were found in Agnes Harvey 1902. No symptoms were found in Pearly Queen 1927.

Division 7 - Jonquil Hybrids: Typical white-streak symptoms were found in only one variety in this group, namely Golden Sceptre 1914. Doubtful symptoms were observed in White Wedgewood 1927. No symptoms were observed in Buttercup 1890, Campernellii 1908, Lady Hillingdon 1927, or Rugulosus 1927.

Table 1. Distribution of white streak in narcissus varieties.

Horticultural group and division	Total number varieties observed	Number varieties showing typical white streak	Number varieties showing doubtful symptoms	Number varieties showing no symptoms	Year of oldest variety showing 2% or more white streak	Year of oldest variety showing no white streak
Division 1a Yellow Trumpets	16	12	2	2	1899	1900
Division 1b White Trumpets	5	2	-	3	1910	1920
Division 1c Bicolors	11	8	-	3	1897	1907
Division 2a Incomparabilis Yellow Shades	12	2		10	1912	1884
Division 2b Incomparabilis Bicolors	9		1	8	-	1890
Division 3a Barrii Yellow Shades	6	-	-	6		1886
Division 3b Barrii Bicolors	8	1	-	7	1908	1907
Division 4a Leedsii Medium Trumpets	1	-		1		1927
Division 4b Leedsii Short Trumpets	3	-	-	3		1890
Division 5b Triandrus Hybrids	3	1	1	1	1907	1927
Division 7 Jonquil Hybrids	6	1	1	4	1914	1890
Division 8 Tazetta	9	1	-	8	1916	1907
Division 9 Poeticus Varieties	9	2	-	7	1910	(Species)
Division 10 Doubles	7	1	-	6	Very old	Very old

Division 8 - Tazetta: Typical white-streak symptoms were observed in Lucrece 1916. The following varieties observed showed no white-streak symptoms: Klondyke 1907, Aspasia 1910, Orange Cup 1913, Laurens Koster 1923, Mrs. Asquith 1923, Early Perfection 1930, Majestic 1930, and Sunlight 1931.

Division 9 - Poeticus Varieties: White-streak symptoms were observed in two varieties in this group, namely Socrates 1910 and Eurydice 1914. No symptoms were observed in the following varieties examined: Homer 1898, Epic 1904, Chaucer 1907, Edwina 1926, Mme. Sans Gene 1927, Poeticus var. recurvus, Poeticus var. ornatus maximus.

Division 10 - Doubles: White-streak symptoms were observed in one lot of the very old variety Van Sion. No symptoms were found in Albus plenus odoratus, Poeticus var. Flore pleno, Mary Copeland 1914, Cheerfulness 1923, Orange Phoenix, Tea Rose, or Sulphur Phoenix. This last group represents a very artificial classification of specifically unrelated forms. Van Sion at one locality showed a trace (i.e., less than 0.5 percent). This observation points to natural spread into the group since this variety was entirely free from the disease in most localities.

Table 1 indicates that in Northwest plantings the disease is present in proportionately more of the large trumpet varieties than in the other groups, 22 out of 32 varieties studied showing positive symptoms. The Leedsii forms showed none. The finding of typical cases in 2 out of 21 varieties of Incomparabilis, 1 out of 14 Barrii, 1 out of 3 Triandrus hybrids, 1 out of 6 Jonquil hybrids, 2 out of 9 Poeticus, and 1 out of 7 Doubles suggests wide susceptibility within narcissus varieties.

On a percentage basis 69 percent of the large "trumpet" varieties showed the disease while only 12 percent of the varieties representing all the rest of the groups exhibited typical cases. The lowest and highest percentages of infection within a variety both occurred in the yellow trumpets. The data on the varieties in the above tabulations frequently represent several plantings or lots. The percentage of infection was reasonably constant for each variety at different localities except the very old variety Van Sion. Old American stocks of this variety showed none while one more recently introduced stock showed about 3 percent. This erratic varietal distribution indicates an ineffective vector or means of spread. Moreover, the disease seems to be of comparatively recent origin. King Alfred, introduced in 1899, is the oldest variety that exhibited a significant amount of the disease in every lot examined.

(Oregon Agricultural Experiment Station and Division of Fruit and Vegetable Crops and Diseases, U. S. Bureau of Plant Industry, cooperating).

BRIEF NOTES ON PLANT DISEASES

HOST PLANTS OF THE CHARCOAL ROT FUNGUS IN CALIFORNIA: Since the initial report of charcoal rot (Rhizoctonia bataticola [Taub.] Butler) on beans and corn in California in 1932 (Mackie, Phytopath. 22: 637-644. 1932), additional economic hosts have been added. This host list now includes corn (Zea mays, all classes), common bean (Phaseolus vulgaris), Mung bean (P. aureus), large and baby lima bean (P. lunatus), cowpeas (Vigna sinensis), pigeon peas (Cajanus indicus), soybeans (Soja max), and sesame (Sesamum indicum). This list may be expected to extend to other economic and weed hosts. As indicated by Kendrick (Phytopath. 23: 949-963. 1933) and Tompkins and Gardner (Hilgardia 9: 219-230. 1935), charcoal rot is a high temperature fungus and attacks seedlings when high temperatures prevail. For all of the hosts reported the severe and lethal attacks of charcoal rot in California occur mainly when the plants are about full stature, nearing maturity. Irrigation may prevent charcoal rot in cowpeas and limas, while dry or sandy soils, on the other hand, may favor attack through high temperatures. Charcoal rot is commonly present in plantings of soybeans in the hot interior regions of the State, and is a contributing cause restricting successful yields of seed. New hybrid resistant varieties of Blackeyes are now available.

The pycnidial form of the fungus (Macrophomina phaseoli [Maubl.] Ashby) has not been found. (W. W. Mackie, California Agricultural Experiment Station. December 11).

PHYTOPHTHORA CROWN CANKER OF DOGWOOD FOUND IN MASSACHUSETTS: A crown canker of dogwood was found for the first time in Massachusetts on June 27, 1939, in Amherst. The canker occurred on 5 trees, some of which were already dead. Isolations from the infected bark yielded Phytophthora cactorum, the same fungus which is the cause of the serious canker disease of dogwoods on the western end of Long Island. (C. J. Gilgut, Massachusetts State College. December 15).

DECEMBER WEATHER

(From U. S. Department of Agriculture, Weather Bureau, Weekly Weather and Crop Bulletin for week ending January 9, 1940).

Notwithstanding low temperatures that overspread most of the country the latter part of December, the month, as a whole, was abnormally warm throughout practically the entire country; only a few widely scattered stations in the more eastern States reported subnormal temperatures, and they only 1° or 2° below normal. In the Ohio Valley and Lake region, and generally west of the Mississippi River, temperatures for the month averaged from 5° to as many as 20° above normal, the greatest plus departures being in the northern Great Plains.

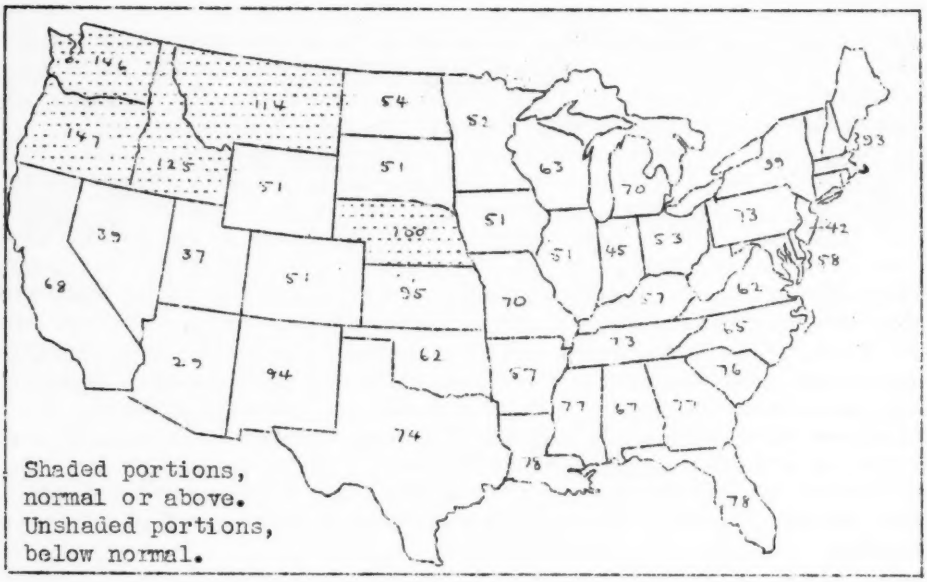


Fig. 1. Percentage of normal precipitation for December 1939.

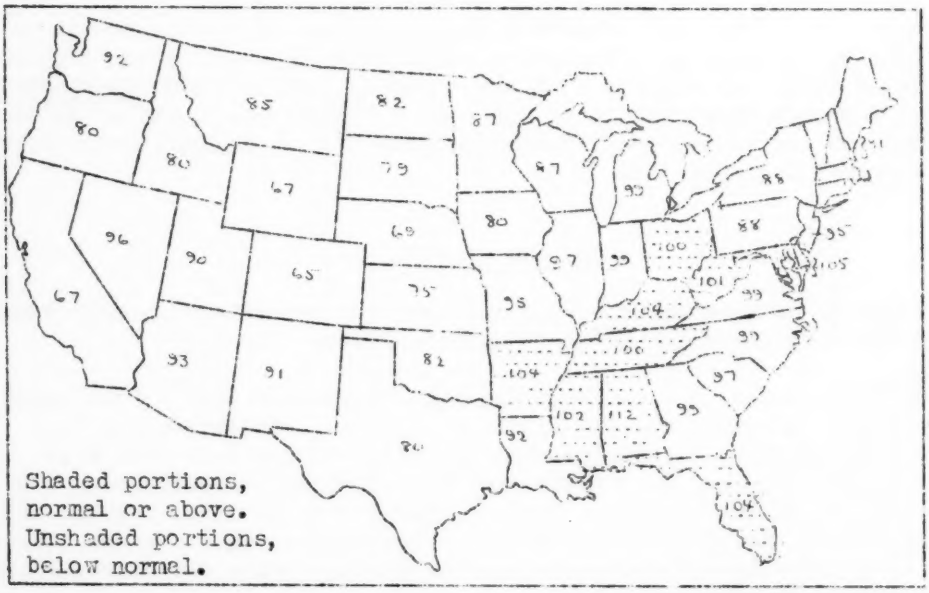
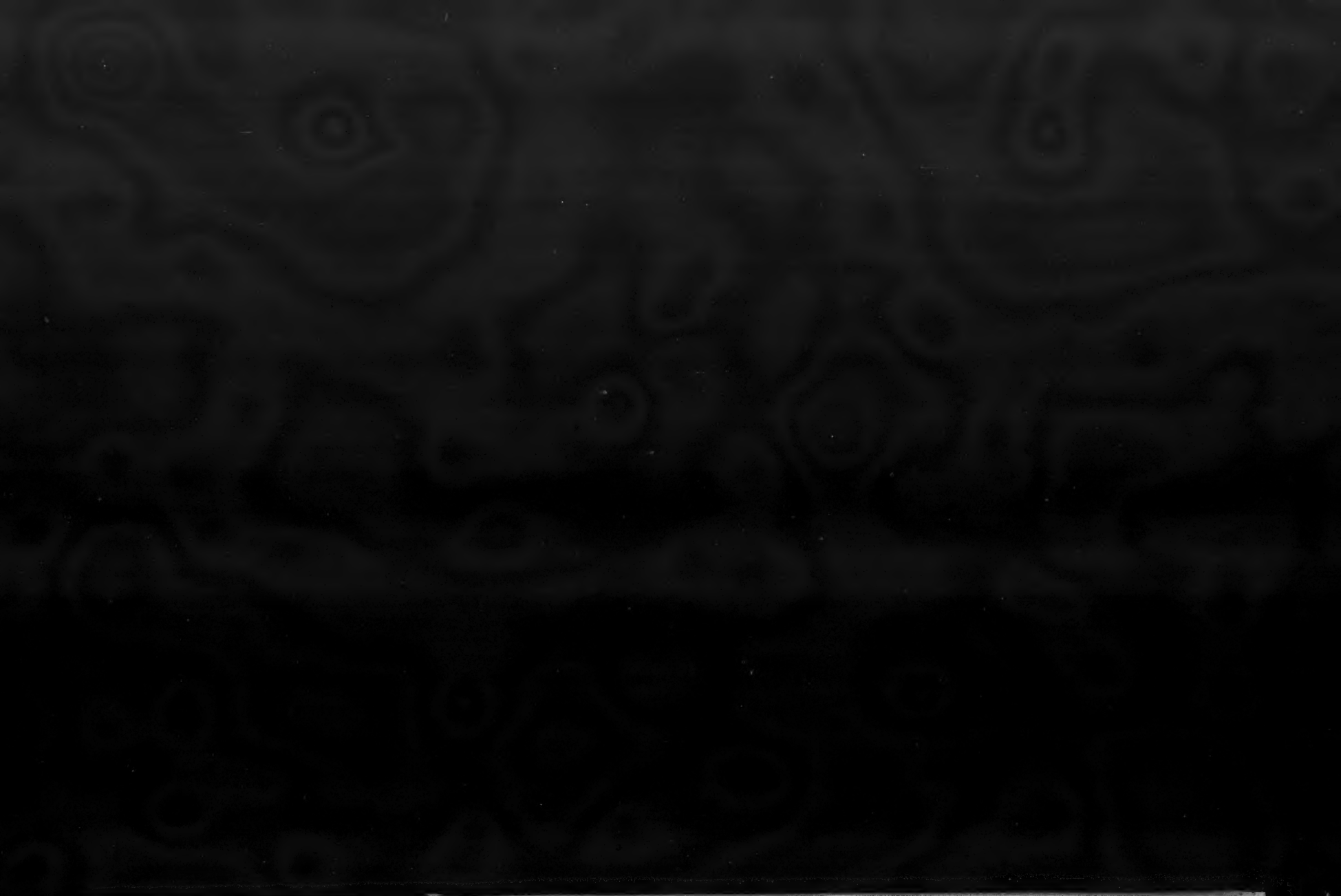


Fig. 2. Percentage of normal precipitation for the year 1939.

Fig. 1 shows the percentage of normal precipitation for December by States. While the figures are considerably greater than for the preceding month of November, published in the December 12 issue, precipitation continued below normal over much the greater part of the country. The four farthest Northwestern States had considerably above normal, and Nebraska exactly normal for the month. For all other States the amounts were deficient, decidedly so in large areas. The relatively driest State was Arizona, with only 29 percent of normal precipitation for the month.

PRECIPITATION IN 1939

(From Weekly Weather and Crop Bulletin for week ending January 9, 1940).

Fig. 2 shows for the year 1939 the percentage of normal precipitation, also by States. Except in the Northeast, the total falls for the year were approximately normal to somewhat above normal rather generally from the Mississippi Valley eastward. West of the Mississippi River all States, except Arkansas, had below-normal precipitation for the year, the relatively driest being Colorado, with only 65 percent of normal, followed closely by California with 67 percent. The relatively driest of the Great Plains States were Nebraska with 69 percent and Kansas 75 percent of normal.

Alabama, with 59.33 inches, had the most rainfall for the year, and Nevada 8.45 inches, the least, though this was only slightly below normal. The total yearly falls in the Great Plains and central Rocky Mountain States were as follows: North Dakota, 14.15 inches, the smallest since 1936; South Dakota 15.71, also the smallest since 1936; Nebraska 16.28, and Oklahoma 20.08. Colorado had only 10.68 inches, somewhat less than the previous driest year of record, 10.89 in 1934. The average for Wyoming was 9.48 inches, also somewhat lower than the previous driest year, 9.81 inches in 1902. The California average, 15.85 inches, was the least since 1932.